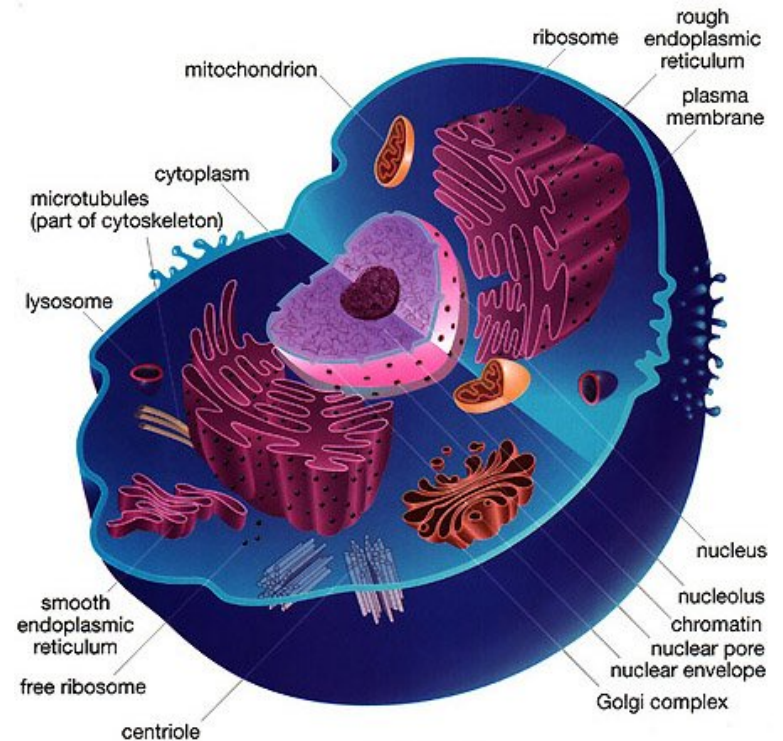
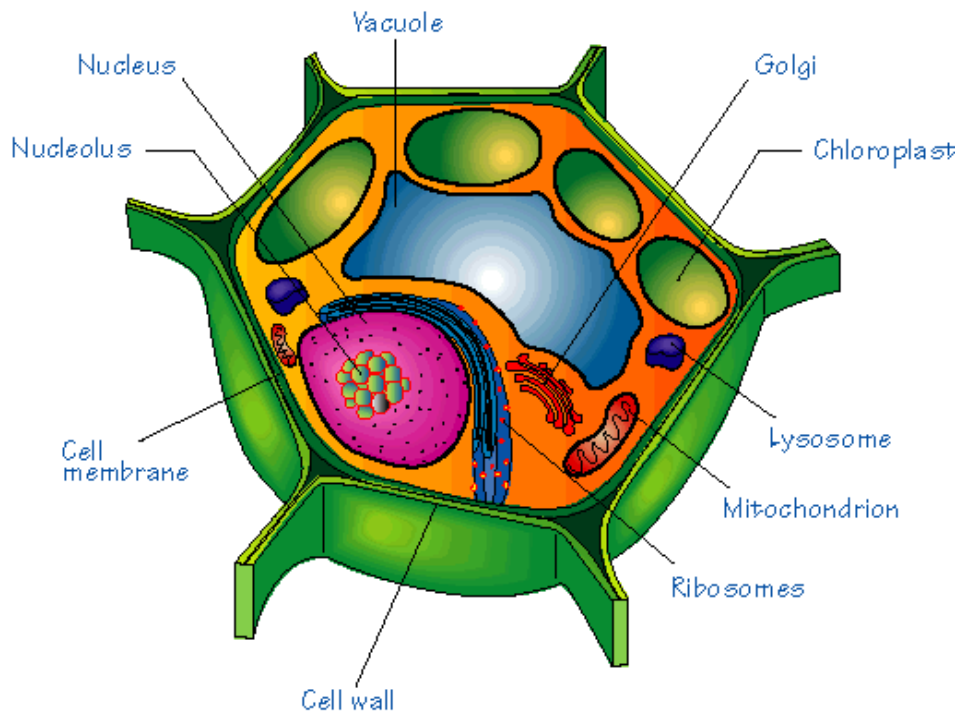


Bacteria: An Overview

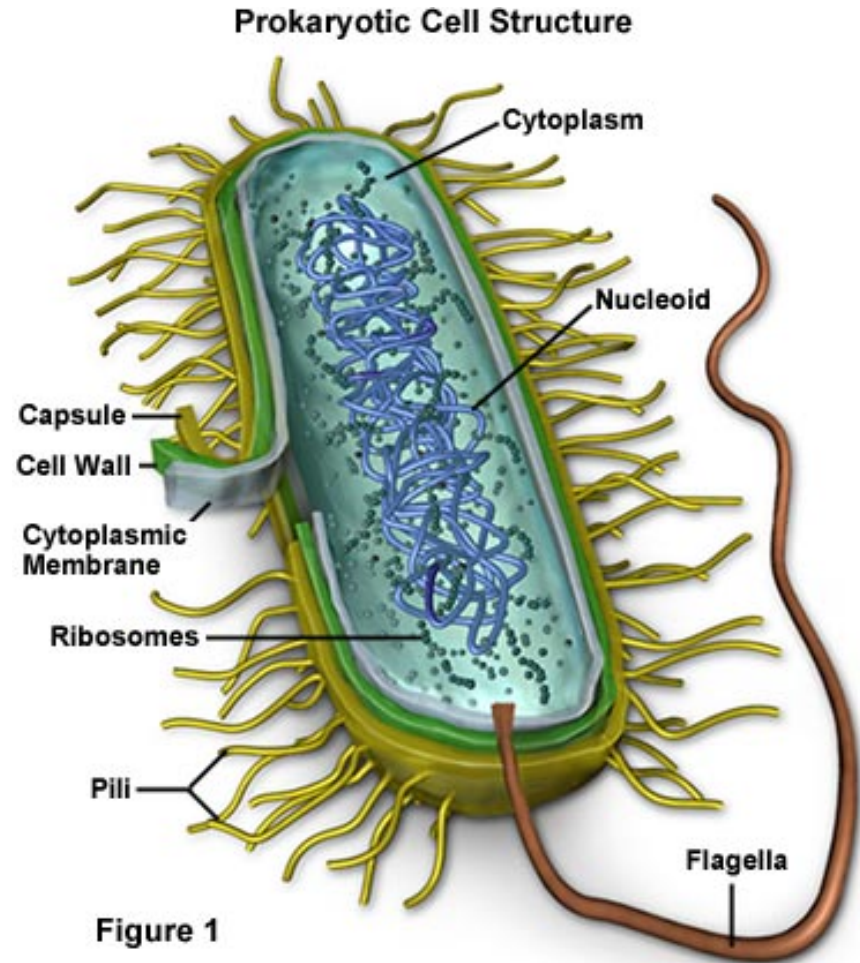
Eukaryotes

- Have **cell membranes** – Some have **cell walls**
- **Structures in confined compartments**
 - Organelles (mitochondria, chloroplasts, vacuoles)
- **Multiple strands of DNA and DNA is in nucleus**



Prokaryotes

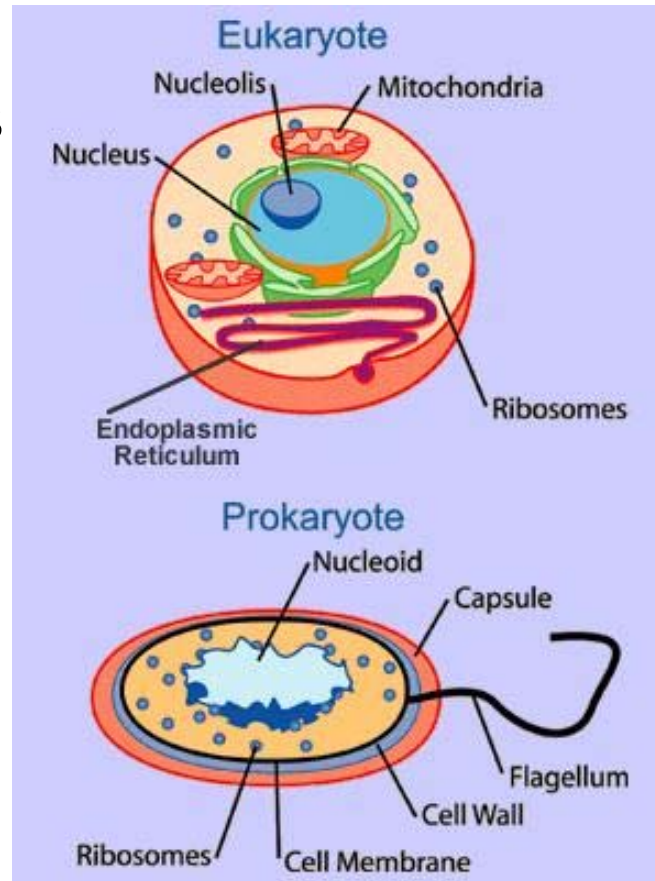
- Bacteria
- Cell membrane
 - Some have an outer layer over membrane
- Cell Wall
- One strand of DNA
- There is no nucleus
- No organelles



Prokaryote vs. Eukaryote

Eukaryote

- Plants and Animals
- Cell membrane
- Some have cell walls
- DNA is inside the nucleus
- Structures are in compartments (organelles)



Prokaryote

- Bacteria
- Cell membrane
- Cell Wall
- DNA floats around, no nucleus
- No organelles

Prokaryotes (aka. Bacteria)

Most successful organisms on Earth (~3.5 BILLION years old)

Two Types of Prokaryotes

Eubacteria

- Cell wall contains **peptidoglycan**
- Most common type

Archaeobacteria

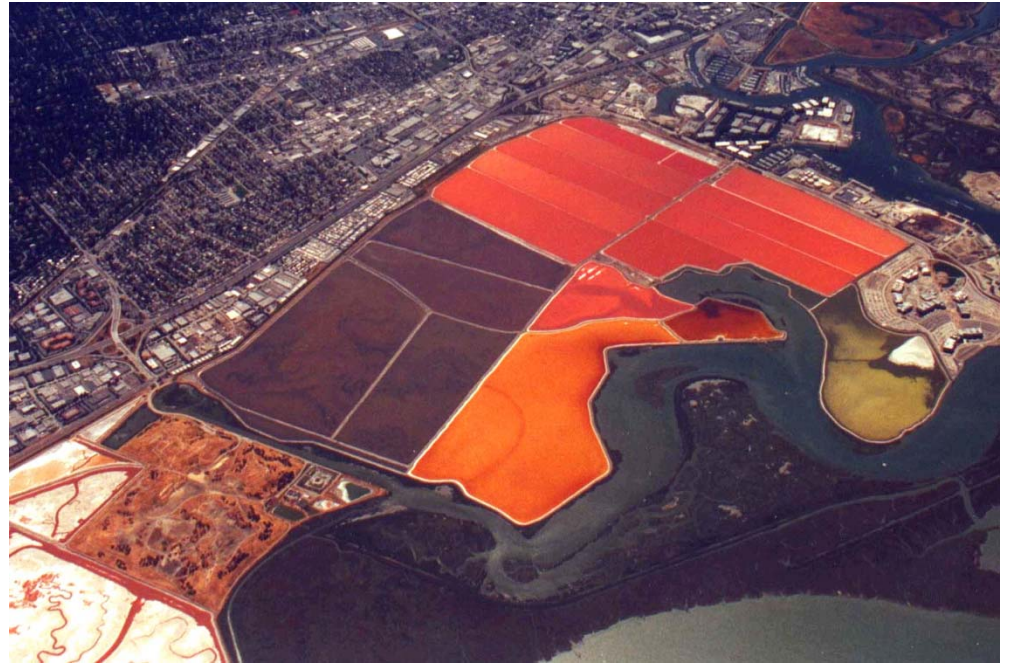
- Cell wall **lacks peptidoglycan**
- Can live in very harsh environments (heat, cold, salt ponds, acidic ponds, no oxygen)
- DNA is more similar to eukaryotes

Hydrothermal Vents



Pink, green, and brown-colored archaeobacteria occupy the thermal gradients in the flowing water (**60-100°C**).

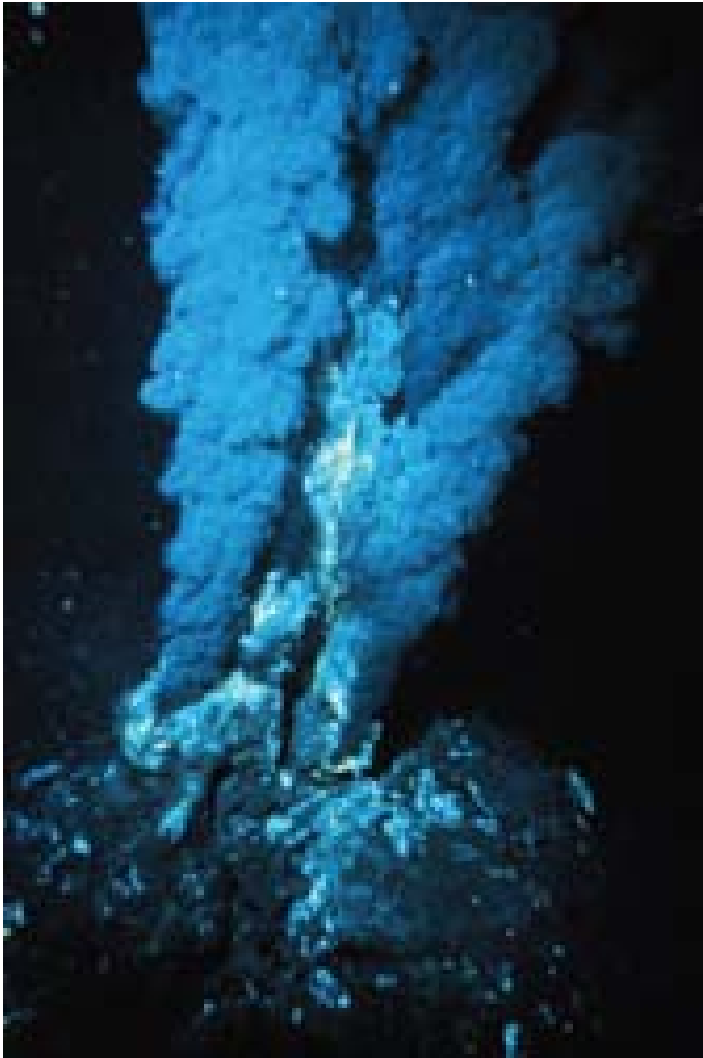
Salt Ponds



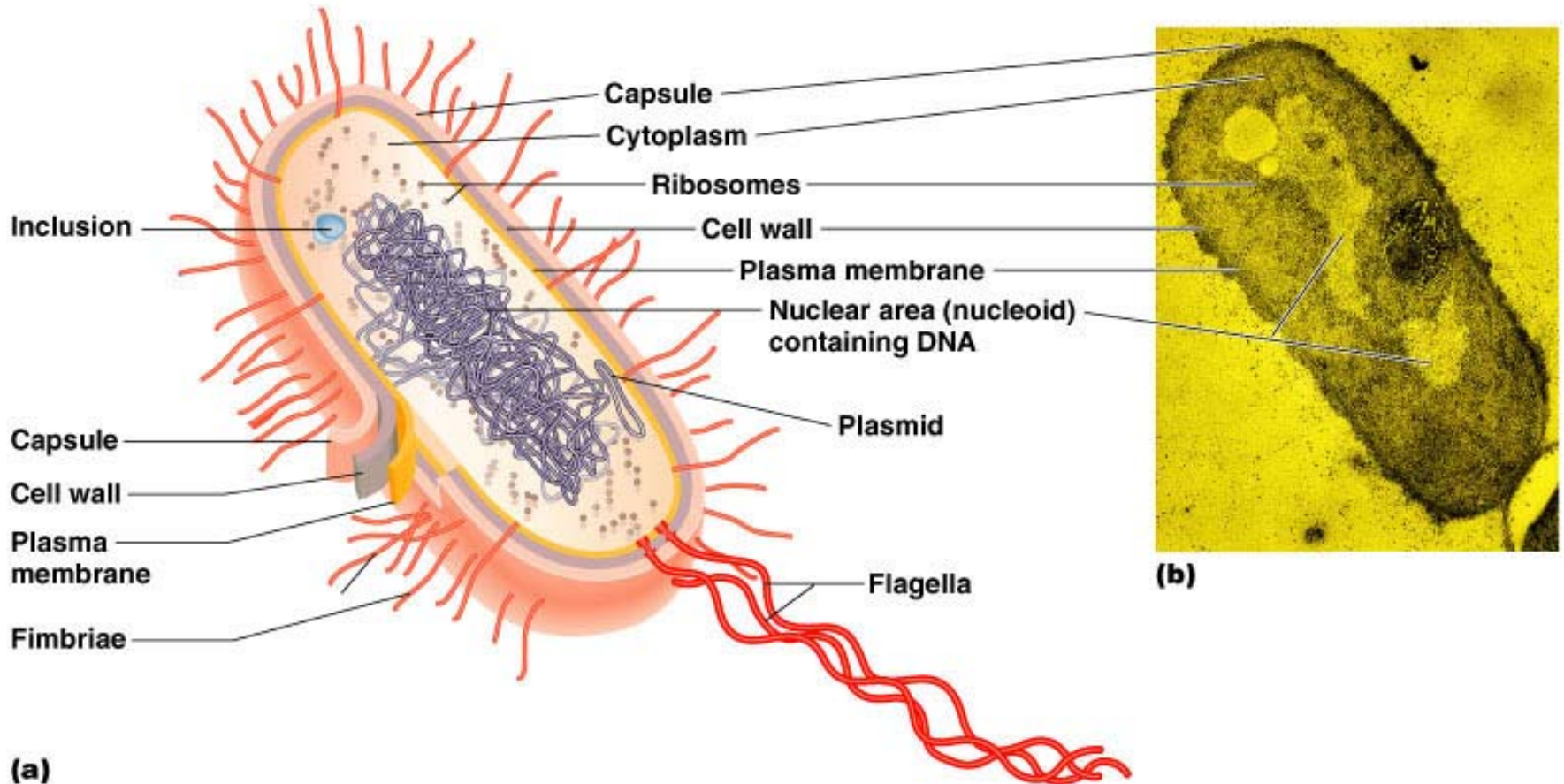
Arctic Ice



Acidic Environments



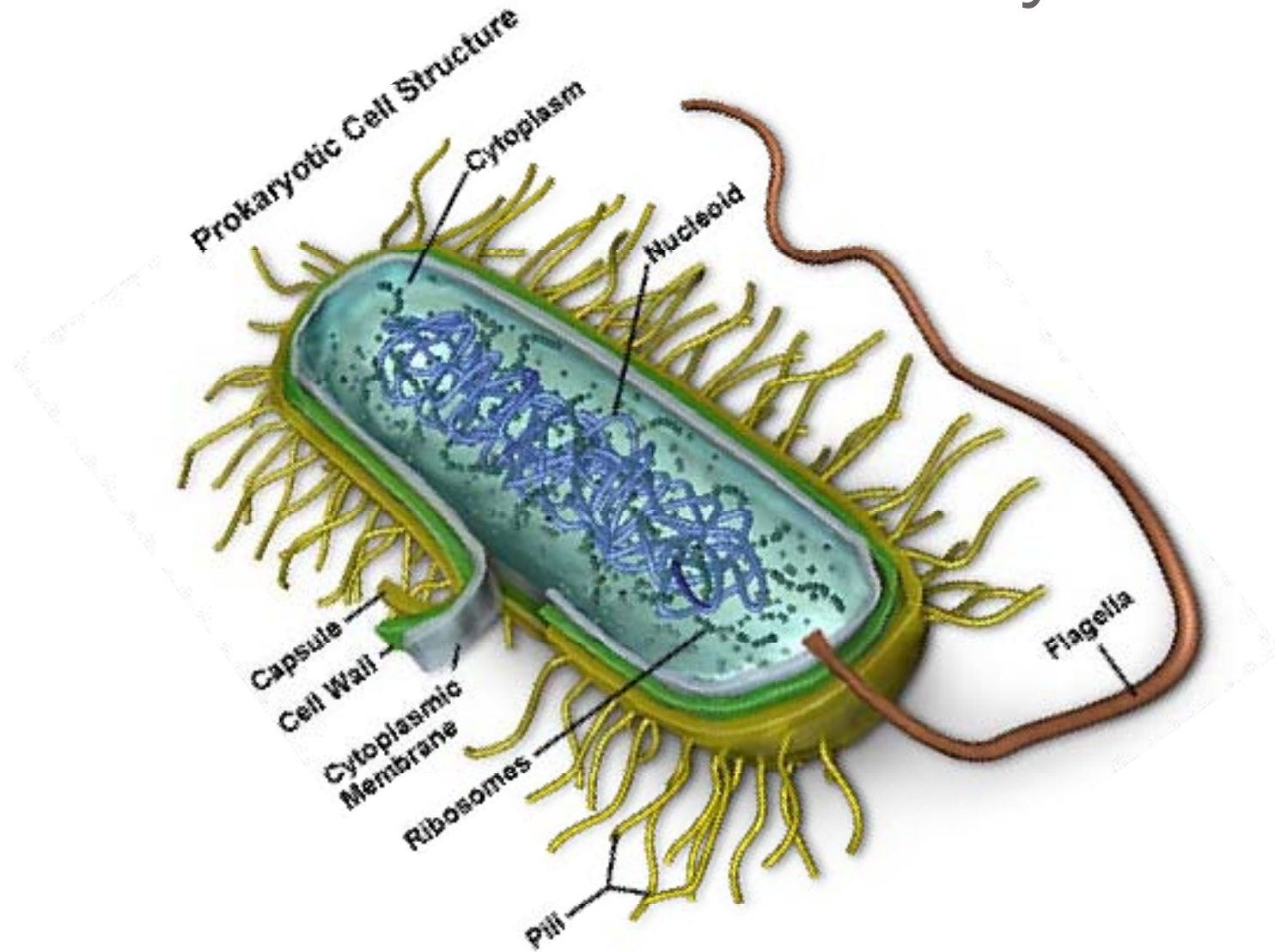
Structure of a Prokaryote



(a)
Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.

Peptidoglycan – Chemical outside Cell Wall

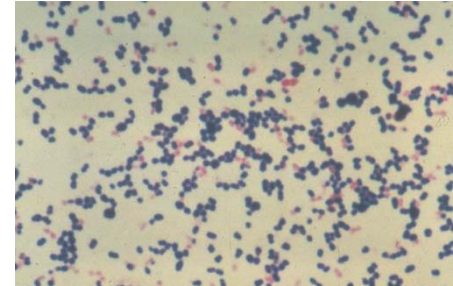
Structure of a Prokaryote



Three Shapes

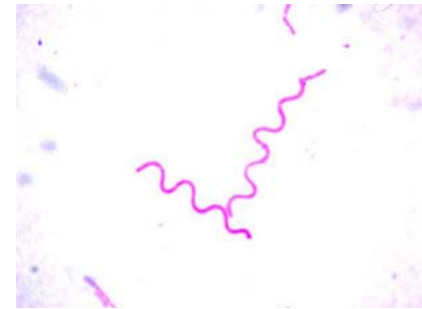
- Spherical – “**cocci**”

- Greek – berry



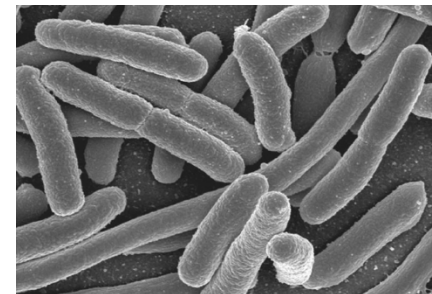
- Spiral – “**spirillum**”

- Latin – spiral

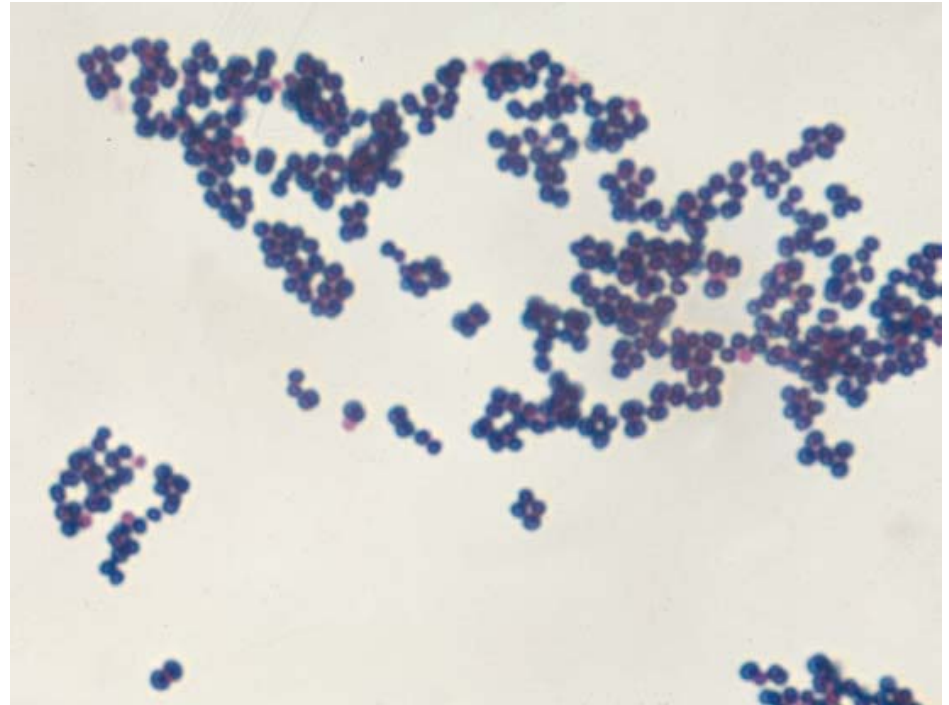
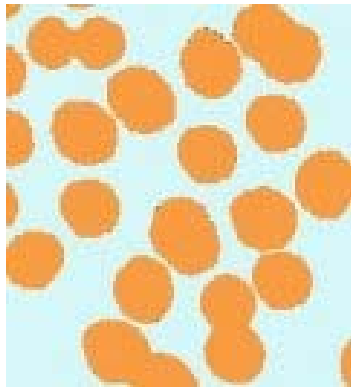
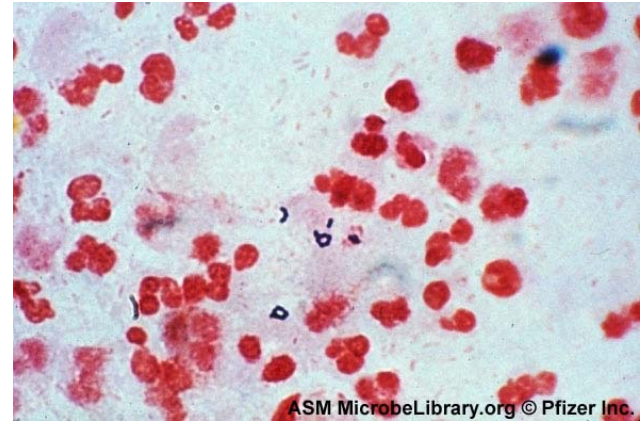
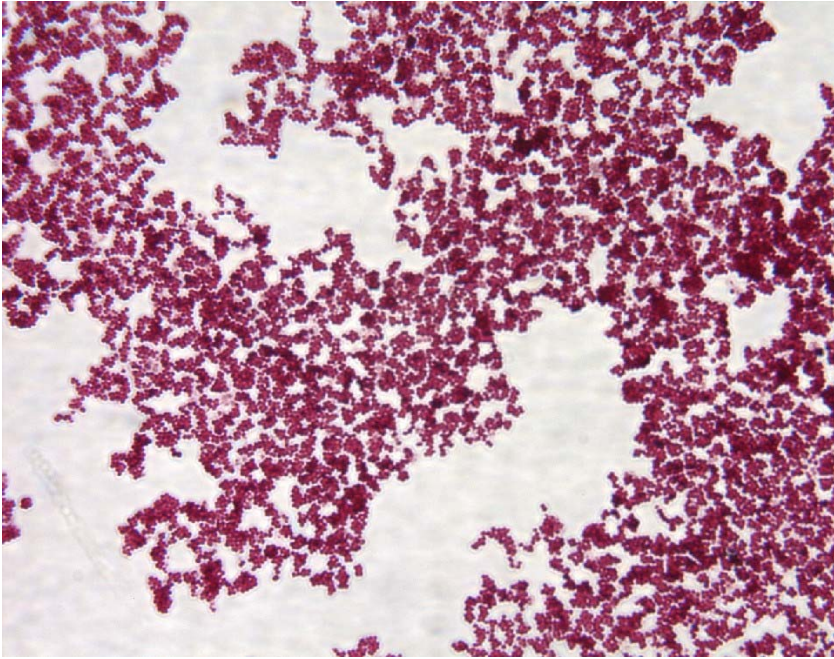


- Rod-shaped – “**bacilli**”

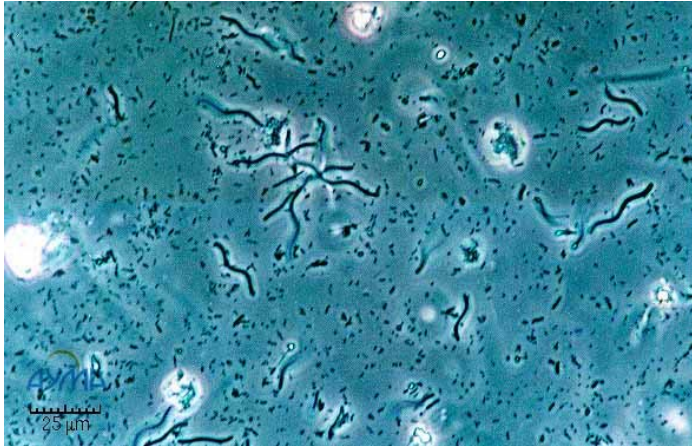
- Latin – little stick



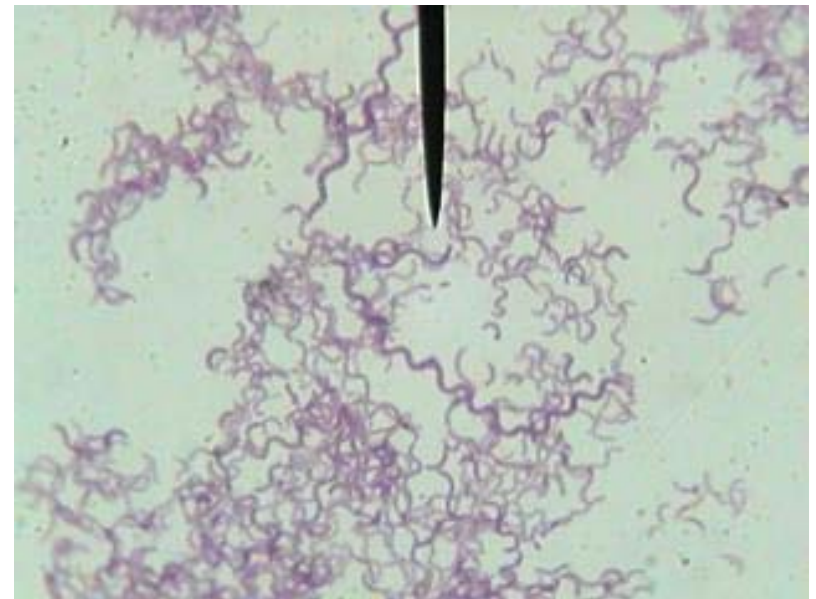
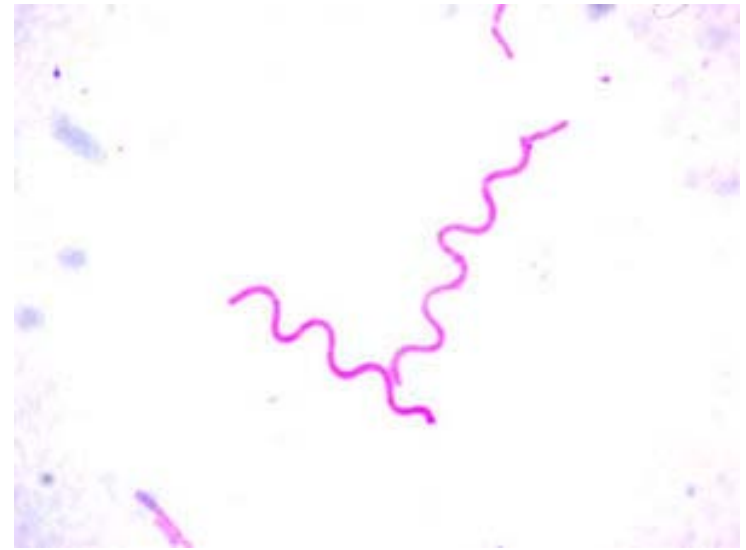
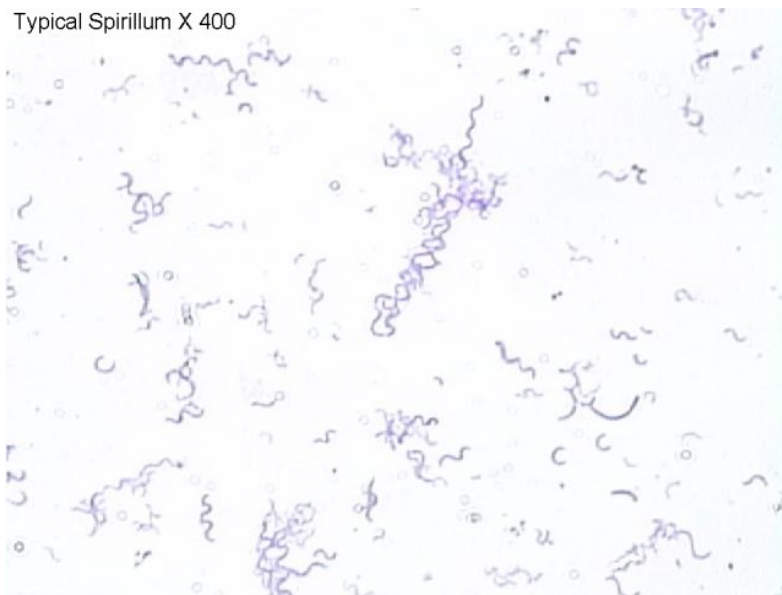
Spherical – “cocci”



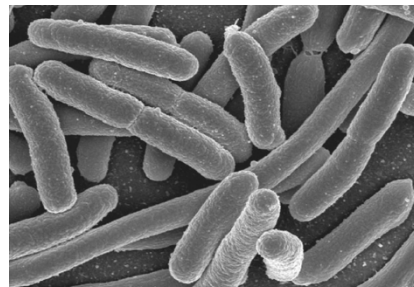
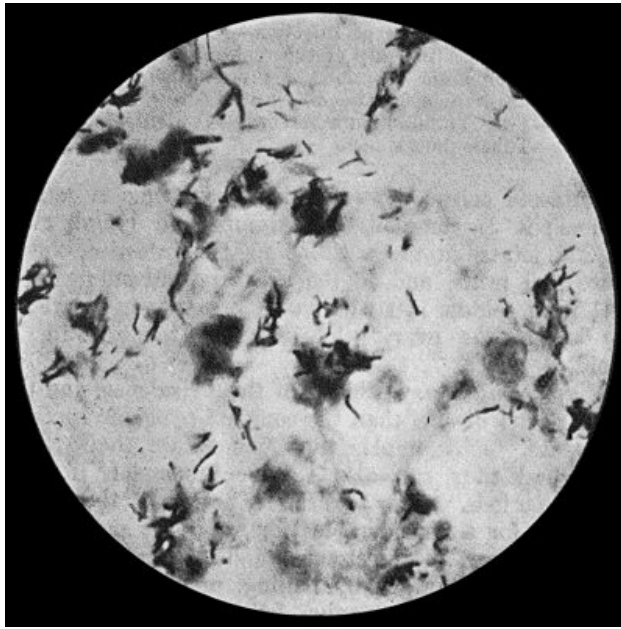
Spiral – “spirillum”



Typical Spirillum X 400

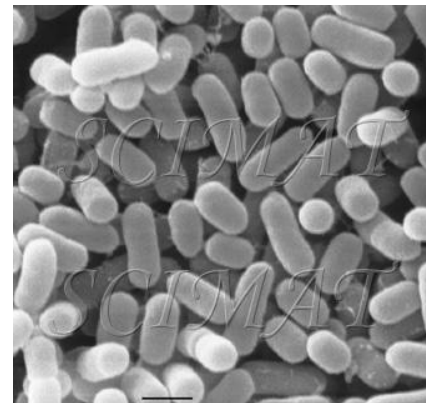
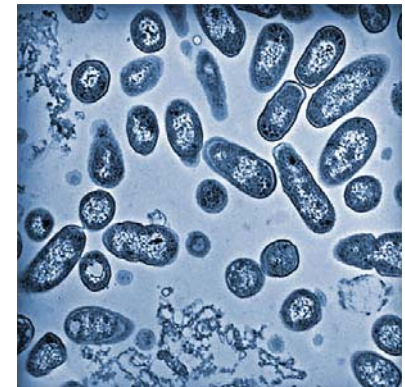
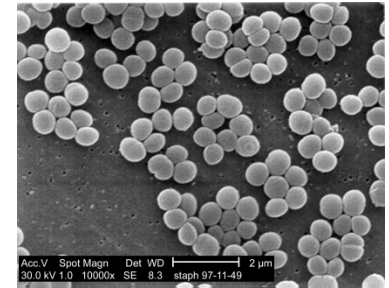
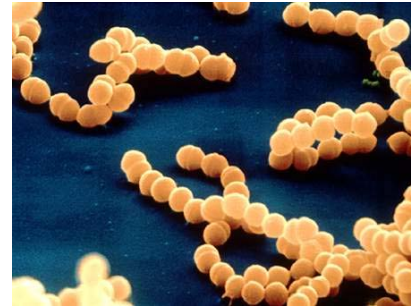


Rod-shaped – “bacilli”



Identify the Bacteria Based on the Name

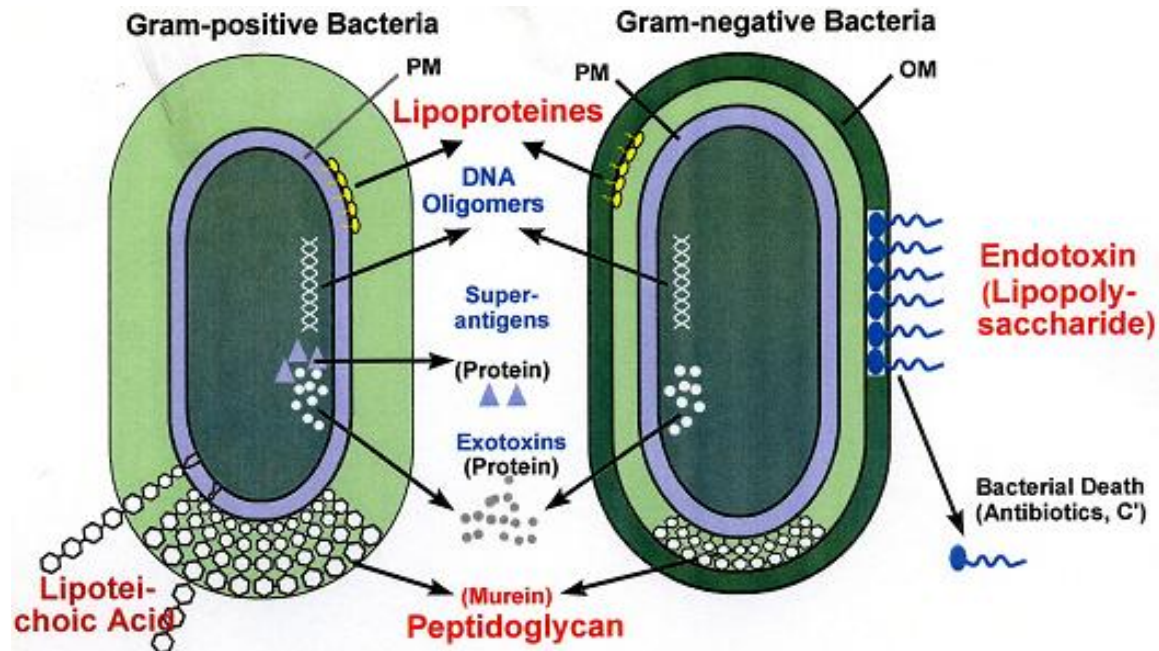
- *Staphylococcus* (in clusters) – causes lots of infections
- *Streptococcus* (in chains) – causes pneumonia, strep throat
- *Clostridium* – causes tetanus, lockjaw, food poisoning
- *Bordetella pertussis* – causes whooping cough
- *Samonella*
- *Escherichia Coli* (*E.coli*) – causes stomach sickness



Identifying Types of Bacteria

- **Gram-staining**

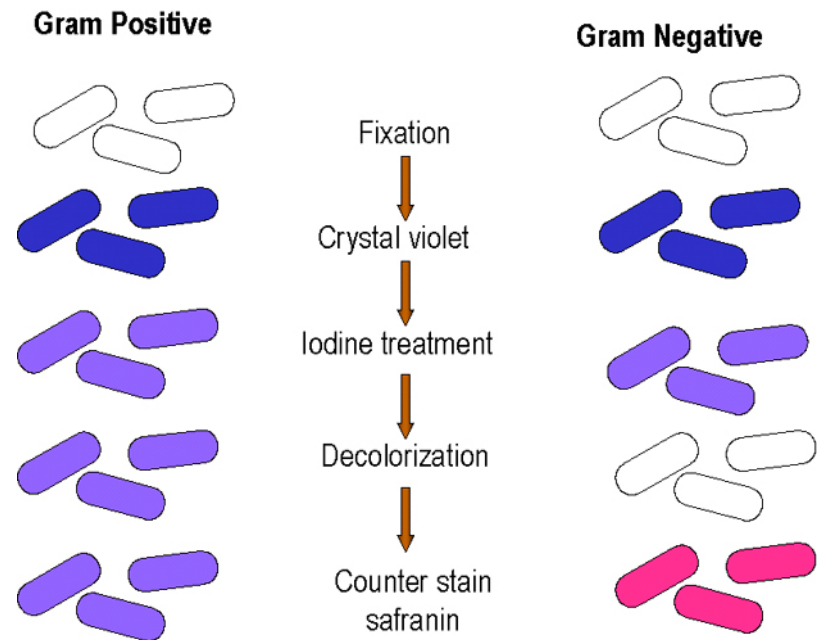
- Used to identify what type of bacteria
- Helps us determine if antibiotics will be effective
 - Cells that have extra layer cannot be penetrated by antibiotics



Gram Staining - Steps

1) Stain it red

- Red stain bonds to **peptidoglycan** in cell membrane
- All bacteria cells have **peptidoglycan** in cell membrane

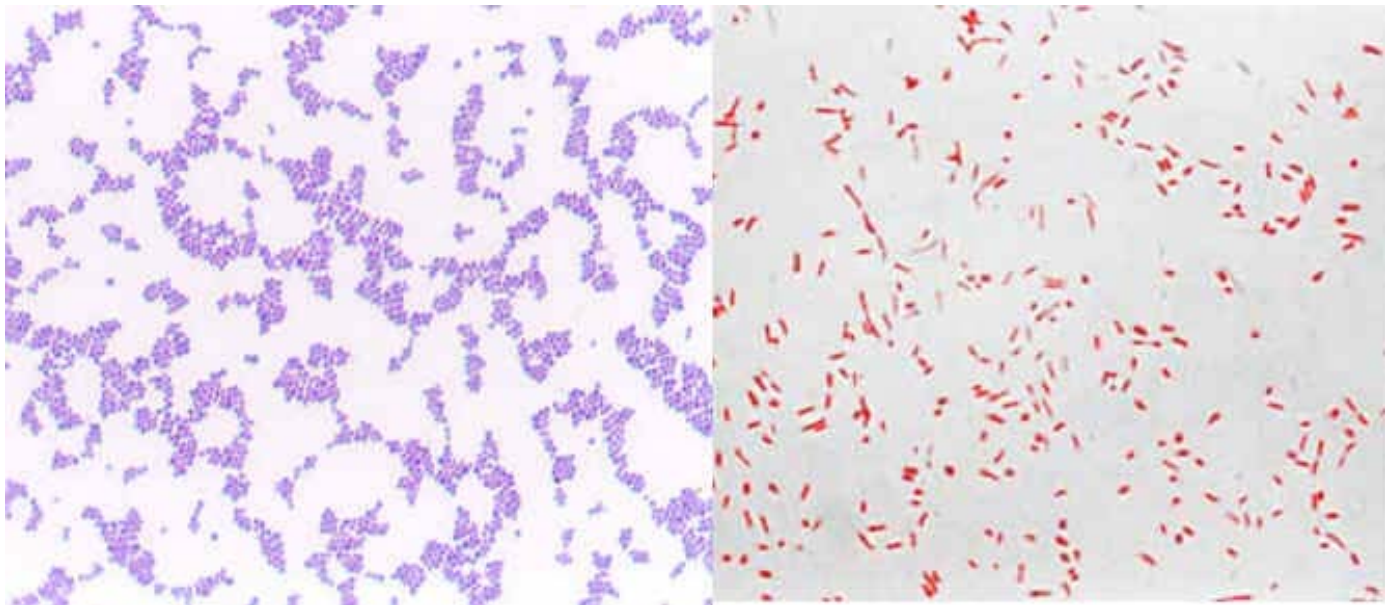


2) Stain it violet

- If bacteria **stays violet** – **gram-positive** (violet stain sticks)
- If bacteria washes back to **red** – **gram-negative** (violet stain washes off)

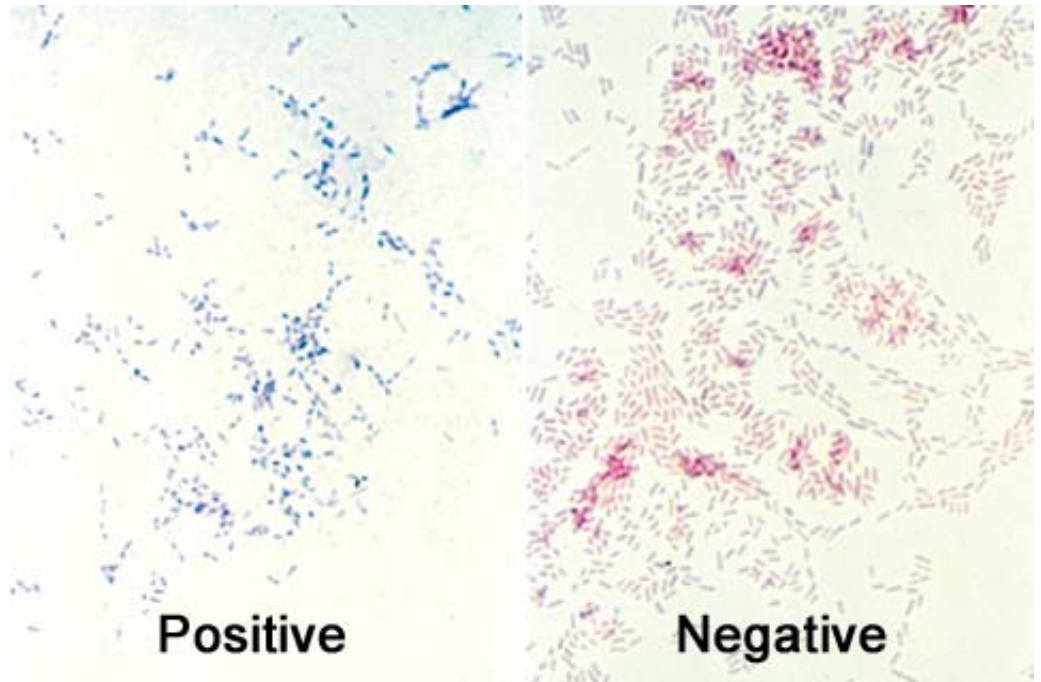
Gram Staining - Results

- **Gram-negative** have extra layer of around cell wall
 - Violet stain bonds to the chemicals in this layer
 - Then gets washed off
- **Gram-positive** do not have extra layer
 - Violet stain bonds to cell wall and stays



Gram Staining - Implications

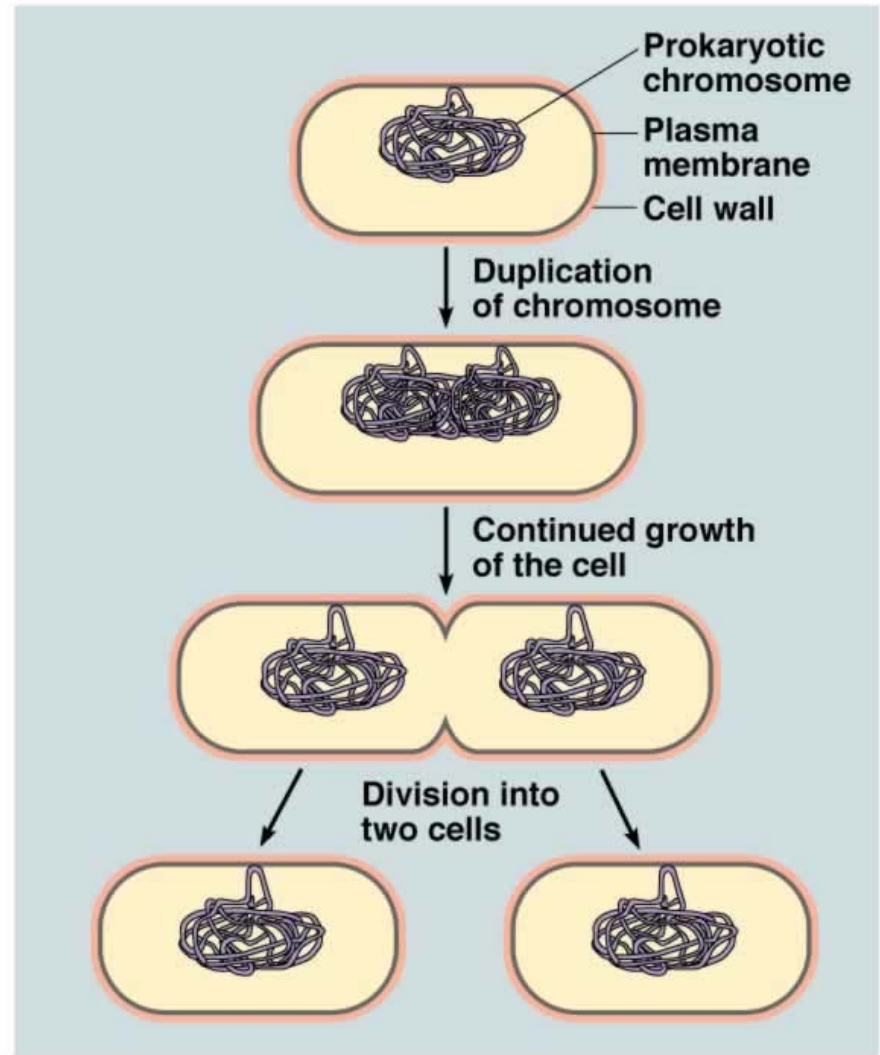
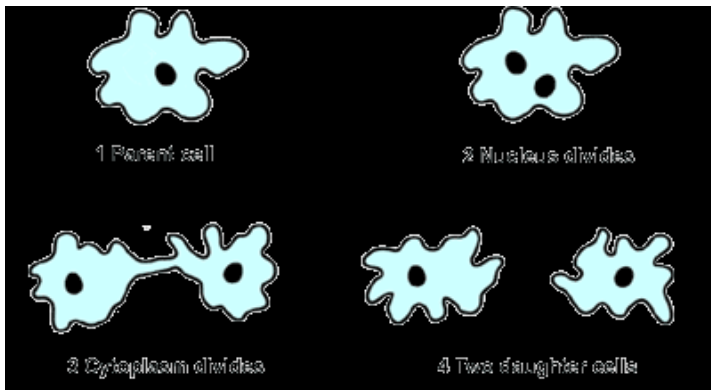
- Gram Negative – Have extra layer outside cell wall
 - Cannot be penetrated by Antibiotics
- Gram Positive – No extra layer outside cell wall
 - Can be penetrated by Antibiotics



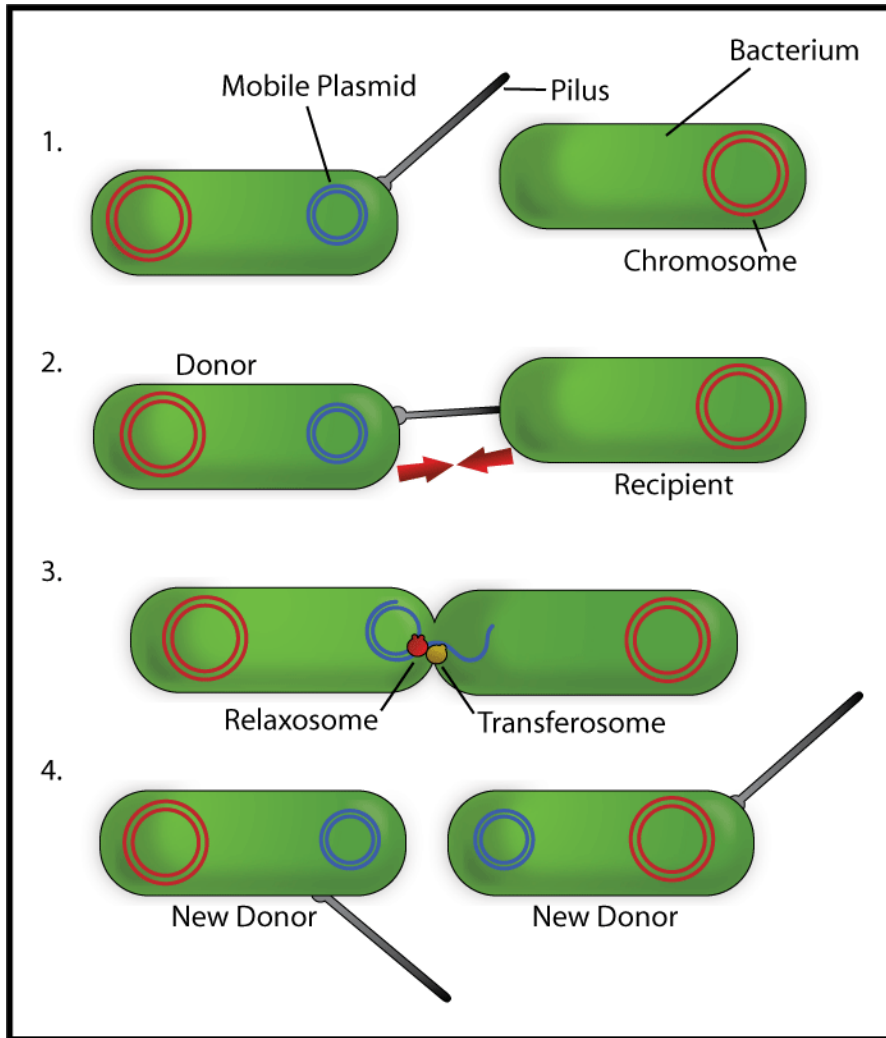
Growth and Reproduction

Binary Fission

- Copy DNA
- Grow
- Split in Two

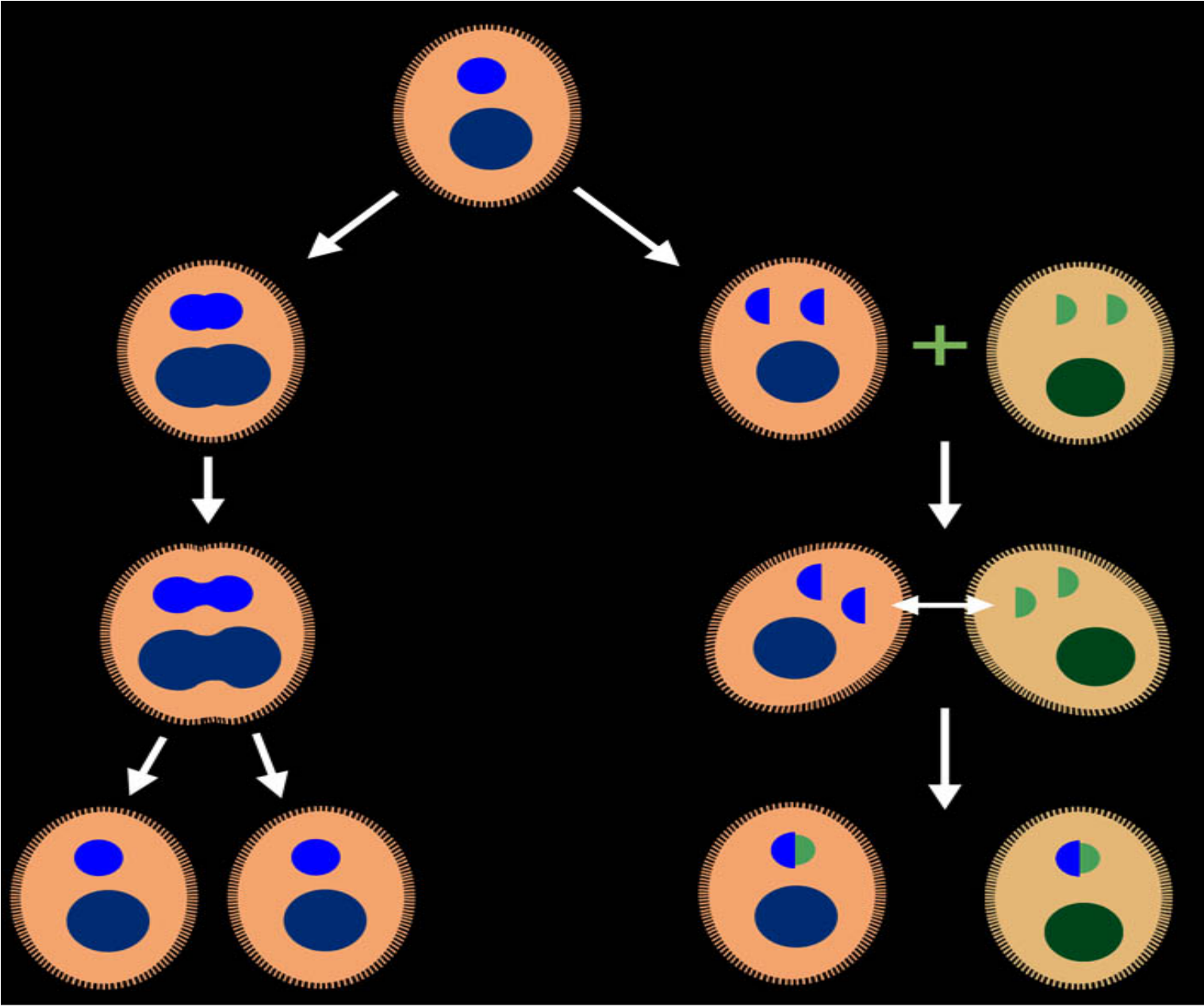


Growth and Reproduction



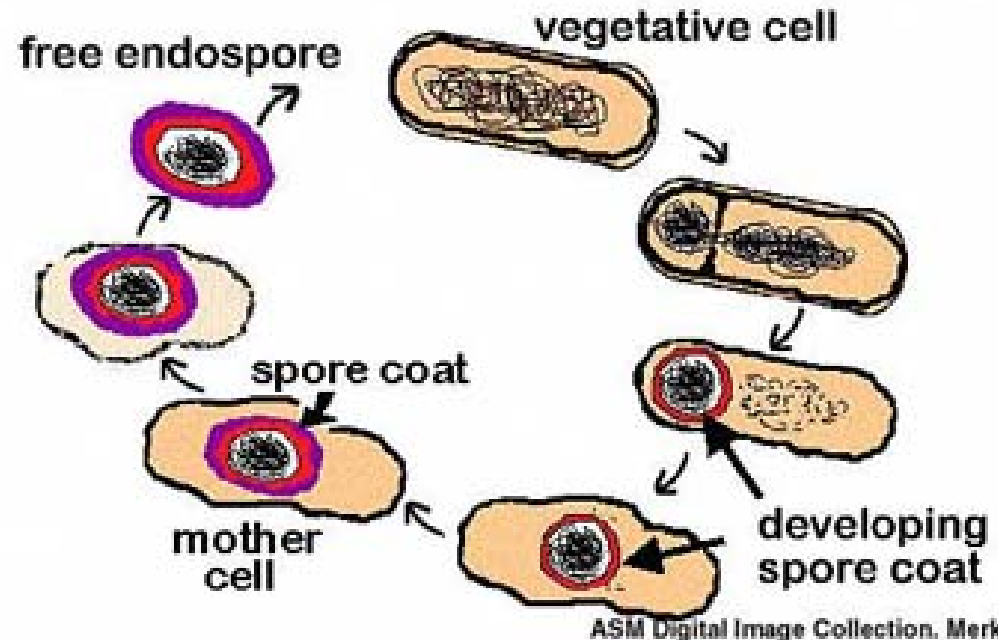
Conjugation

- Create bridge between two bacteria cells
- Exchange genetic information



Growth and Reproduction

- Spore formation
 - Unfavorable conditions
 - Create a cell wall around DNA
 - Bacteria cell lays dormant



Colony Growth

- **Cell division can be rapid**

- Some can multiply once every 20 minutes

- 1→2→4→8→16 →32 2 hour
- 64→128→256→512 →1024→2048 4 hours
- 4096→8196→16382→32764→65528→131056 6 hours
- 262112→524224→1048448 7 hours

- The growth of a colony of bacteria is limited by the nutrients available and by the amount of waste products it produces

- <http://www.tulane.edu/~dmsander/WWW/Video/pneumo.html>

Nutrition

Autotroph

- Makes its own food

Heterotroph

- Gets food from another source

Autotroph

Photosynthetic Autotroph

- Makes food from sunlight
- Cyanobacteria – usually first to recolonize wiped out area
- Blue-green Algae

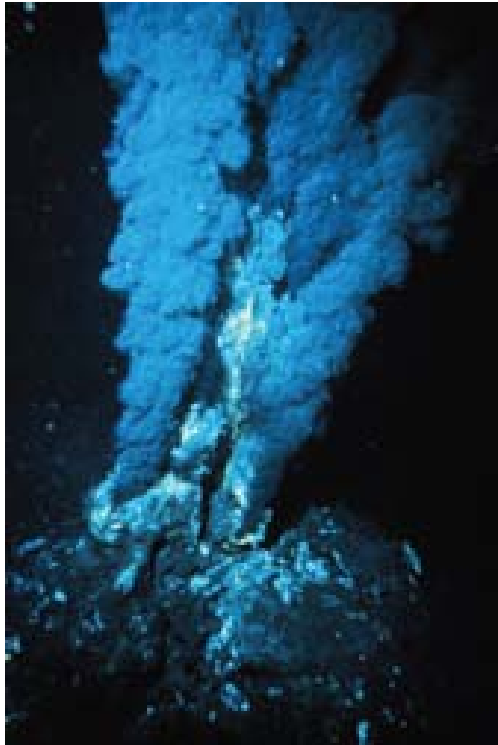
Chemosynthetic Autotroph

- Makes food from other chemicals
- Chemical Vents, Soil, Swamps

Photosynthetic Autotroph



Chemosynthetic Autotroph



Heterotroph

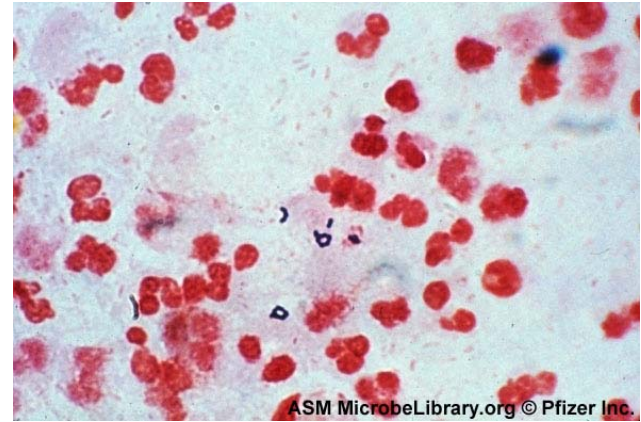
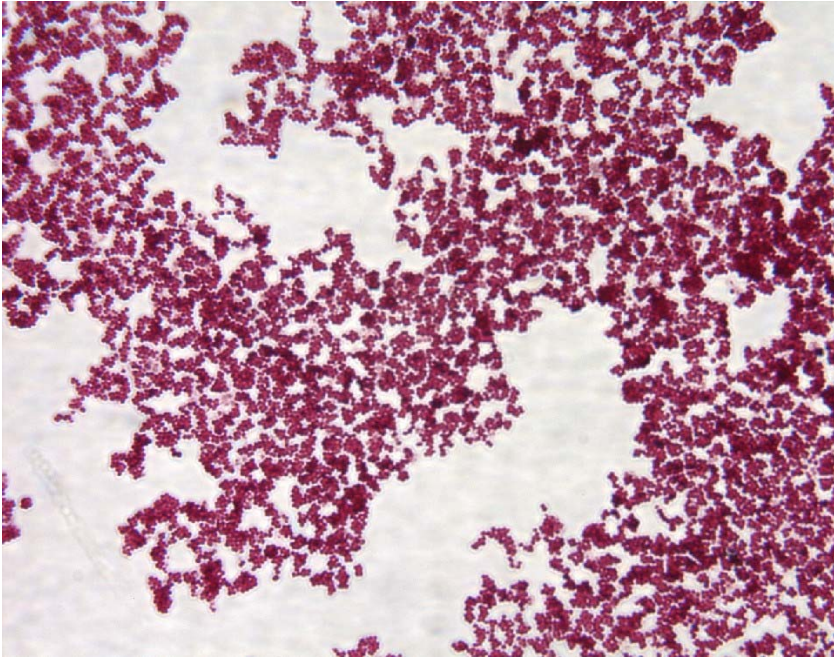
Chemosynthetic Heterotroph

- Uses other cells for energy
- Decomposers
- Parasites

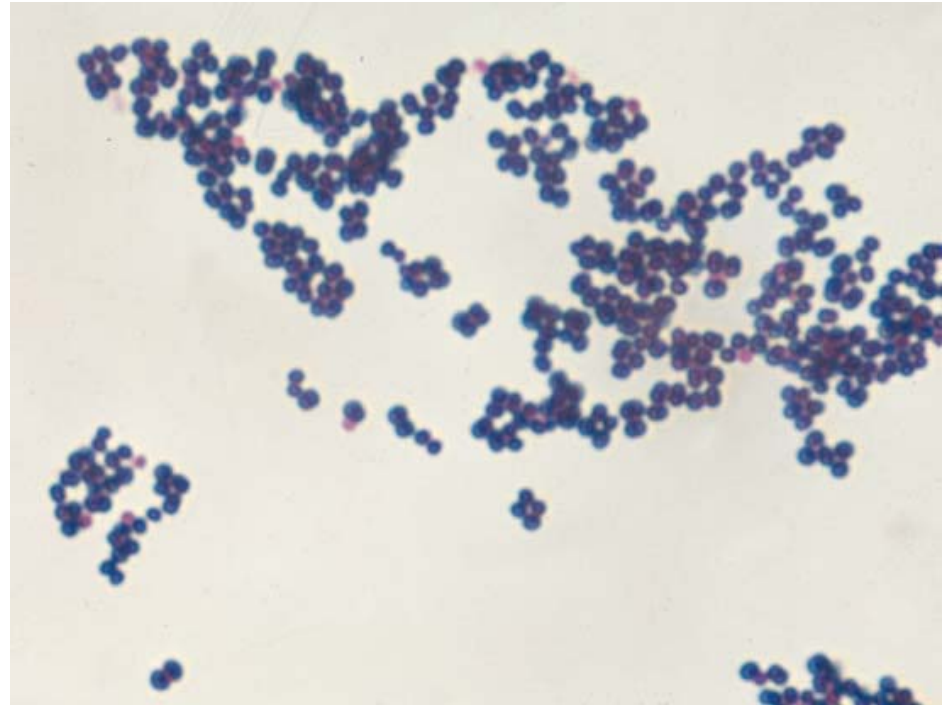
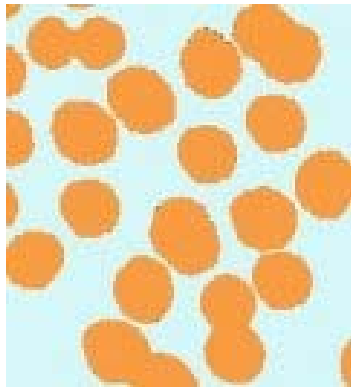
Photosynthetic Heterotroph

- Uses sun for energy
- Uses other cells for carbon

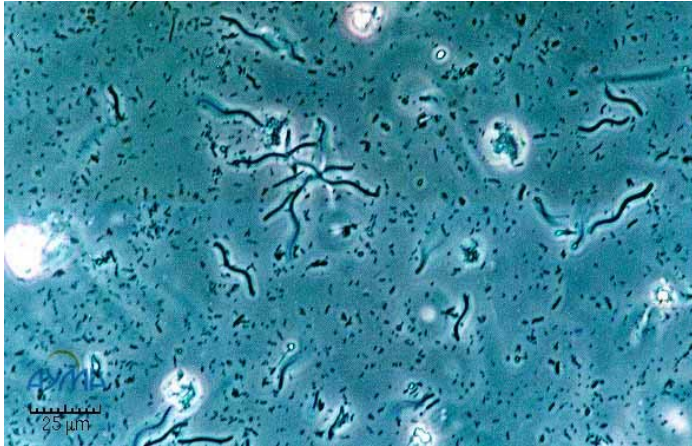
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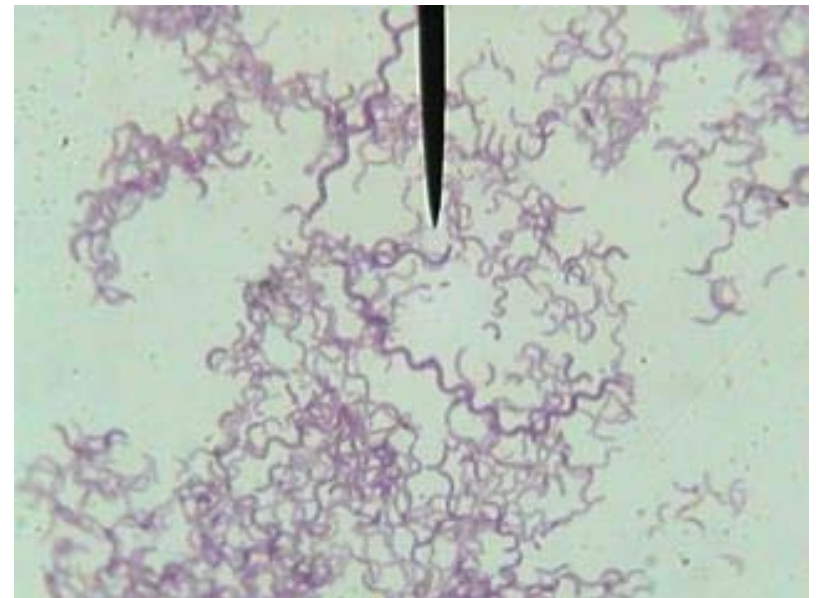
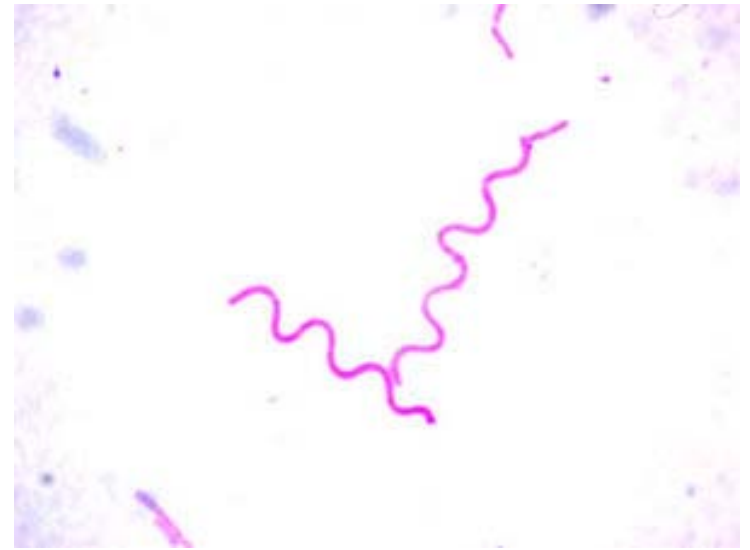
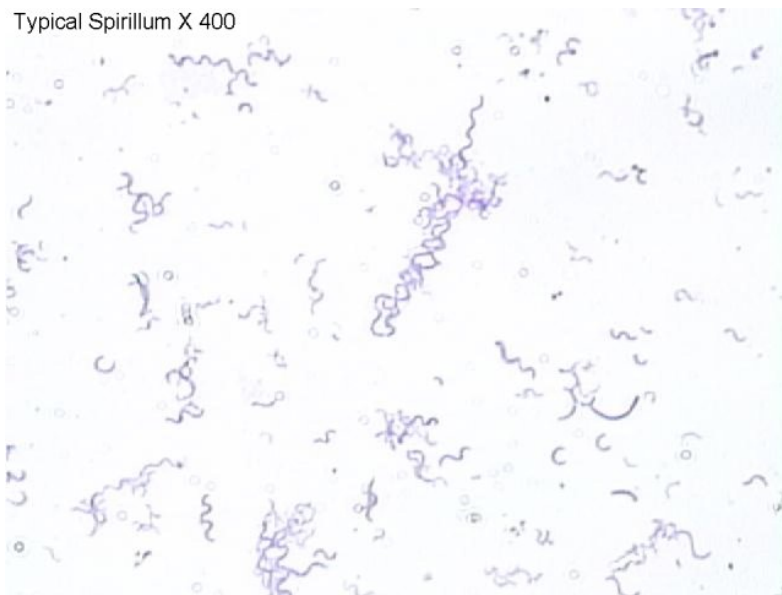
ASM MicrobeLibrary.org © Pfizer Inc.



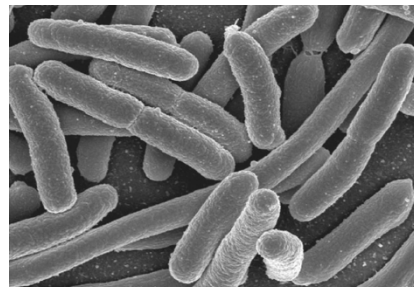
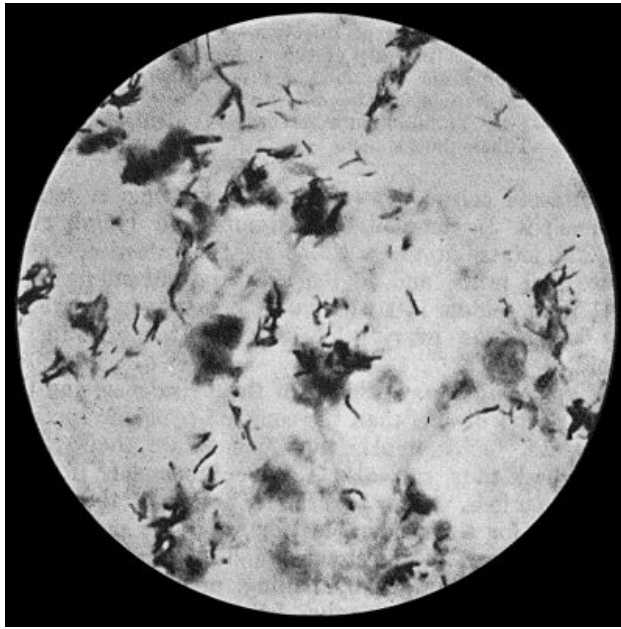
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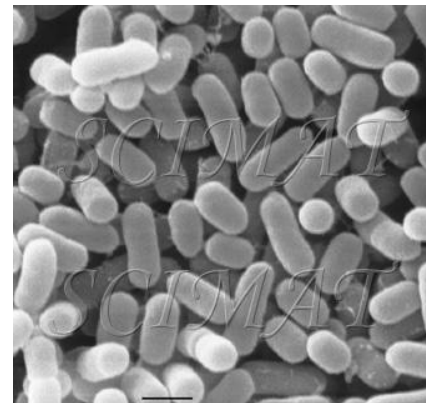
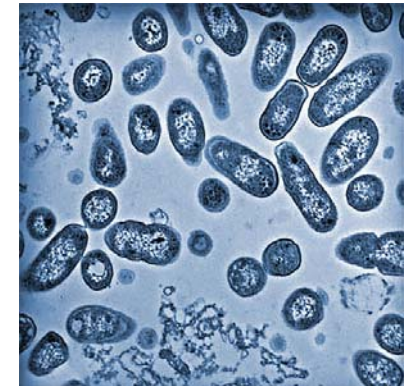
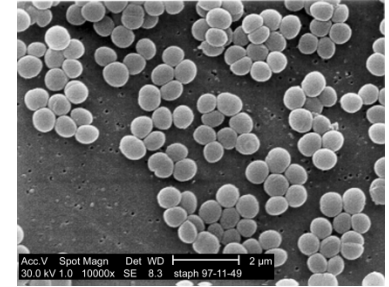
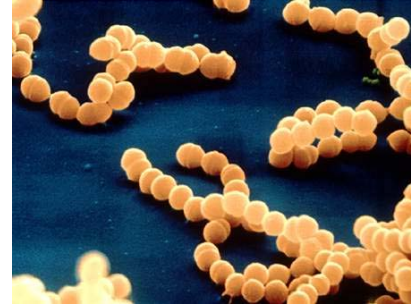


Rod-shaped – “bacilli”



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- *Samonella*
- *Escherichia Coli* (*E.coli*) – causes stomach sickness



Energy Release

- Obligate aerobes
 - Need oxygen to survive
- Obligate anaerobes
 - Destroyed by oxygen
- Facultative aerobes
 - Do not need oxygen, but are not killed by it